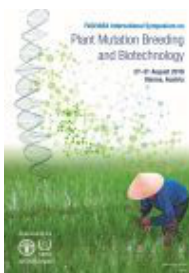


# FAO/IAEA International Symposium on Plant Mutation Breeding and Biotechnology



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## Ion-Beam Mutagenesis –An Innovative and Effective Method for Plant Breeding and Gene Discovery

We have developed a unique technology for mutation induction of plants using energetic ion beams at the RI Beam Factory (RIBF) of RIKEN. Ion beams effectively induce mutations at relatively low doses without severely inhibiting growth. The irradiation treatment can be given to various plant materials and mutation can be induced in a short time between seconds and a few minutes. We have collaborated with companies and agricultural experiment stations on ion-beam-induced mutation breeding and generated 30 new cultivars including sterile Verbena 'Temari Bright Pink', new color flower of Petunia 'Safinia Rose Veined', tearless onion 'Smile ball' and short-culm Japanese barnyard millet 'Nebari-ko No.2'. The linear energy transfer (LET) of ions depends on the species and velocity. For example, C ions provide LET values from 23 to 290 keV/ $\mu\text{m}$  in water. Since LET intensively affects the mutation frequency, it is an important parameter to determine the most effective irradiation condition in mutagenesis. According to our investigations, the most effective LET (LET<sub>max</sub>) for mutation induction is 30 keV/ $\mu\text{m}$  in Arabidopsis and 23-50 keV/ $\mu\text{m}$  in rice, respectively. Subsequently, we have analyzed on the mutated DNA with morphological mutants. The most mutations were small deletions. Irradiation at LET<sub>max</sub> is effective for plant breeding because of its very high mutation rate and sufficient energy to disrupt a single gene. We built a new beam line to increase available ion species with higher LET and longer range. We aim at advances in examination of the effects of physical factors (e.g., ion species, LET, and dose) on DNA-mutated regions with detection using whole genome sequencing, and elucidation of the mechanism of mutagenesis with ion beams. In addition, the combination of ion-beam induced mutants and genome sequencing technology may enable discovery of genes and thus lead to new field in biology, 'mutagenomics'.

### Country or International Organization

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